CHAPTER 13

Freight Transportation

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Trucking is both a critical component of the Nation's economy and a concern to the traveling public, which shares increasingly crowded highways with freight-hauling vehicles. For reasons discussed in this chapter, freight is a growing part of traffic on our Nation's highways. This growth is straining the condition and performance of the highway system, which in turn affects the ability of trucking to deliver goods in a timely and economical manner. This chapter examines the effects of freight transportation on the performance of the highway system, the consequences of highway performance for freight movement and the Nation's economy, and some of the special investment needs of freight transportation.

The Growth of Freight Transportation

Trucking is a key element of the freight transportation system. Trucks carried three-fourths of the value and two-thirds of the tons of everything shipped by manufacturers, wholesalers, and other industries in the United States in 1997. An additional 12 percent of the value of everything shipped by those establishments went by mail and courier services that used trucks for at least part of their trip. The Nation's highways handled over 1 trillion ton miles of commodities in 1997. This task was accomplished by approximately 21 million trucks traveling a total of more than 412 billion miles. The number and mileage of trucks by industry is shown in *Exhibit 13-1.*

The growth in freight transportation is spurred by continued economic growth. The growth in trucking is stimulated by additional factors, including but not limited to increased demand for just-in-time deliveries of lighter and more valuable goods, major reductions in railroad track mileage, and decentralization of business establishments. As shown in *Exhibit 13-2,* this growth shows no signs of abating. Freight tonnage is forecast to increase by 70 percent between 1998 and 2020. Trucking is forecast to account for the majority of the projected increase.

Trucks and Congestion

In recent decades, trucking grew from a small portion of highway traffic to a significant component of intercity traffic and a major contributor to urban congestion. Although commercial vehicles account for less than 10 percent of all vehicle miles of travel, truck traffic is growing faster than passenger vehicle traffic on U.S. highways. On one-fifth of the mileage of the Interstate System, trucks account for more than 30 percent of all vehicles. The percentage of trucks in the traffic stream is likely to grow substantially if the growth in trucking continues to outpace the growth in passenger travel.

Because of their size and operating characteristics, trucks have a greater effect than personal vehicles on traffic flow and highway level of service. Trucks take up more physical space on the roadway and do not accelerate, brake, or maneuver as well as passenger vehicles. These effects vary according to several factors, including grades, lane width, and type of highway.

Exhibit 13-1 *Trucks, Truck Miles, and Average Miles Per Truck by Major Use*

	1997 Trucks (Thousands)	Percent Change from 1992 to 1997	1997 Truck Miles (millions)	Percent Change from 1992 to 1997	Average Miles per Truck 1997 (thousands)	Percent Change from 1992 to 1997
Total Trucks	72,800.3	23.0	1,044,235.0	32.8	14.3	7.5
Agriculture	3,377.8	–5.0	37,495.4	–5.1	11.1	V
Forestry and Lumbering	276.7	4.6	5,579.8	–8.0	20.2	–11.8
Mining and Quarrying	250.7	13.7	4,679.3	5.9	18.7	–6.5
Construction	6,033.9	21.0	108,145.0	38.4	17.9	14
Manufacturing	729.4	–7.3	16,965.8	–2.5	23.3	5.4
Wholesale Trade	1,264.6	11.3	32,462.4	24.4	25.7	11.7
Retail Trade	2,243.8	15.0	40,273.7	15.6	17.9	V
For Hire Transportation	1,059.4	19.1	72,854.9	40.5	68.8	18
Utilities	663.8	22.7	9,437.6	25.8	14.2	2.2
Services	4,233.5	35.5	71,034.5	45.7	16.8	7.7
Daily Rental	508.0	65.1	13,067.7	90.4	25.7	15.2
One Way Rental	31.2	82.5	656.4	71.7	21.1	–5.8
Personal Transportation	50,934.5	25.9	631,346.5	36.1	12.4	7.8
Not in Use	1,193.1	21.6	236.0	–50.0	0.2	–60.0

Source: U.S. Dept of Commerce, Bureau of the Census, Vehicle Inventory and Use Survey, 1997, Report EC97TV-US, Table 2a.

Exhibit 13-2 *Estimates and Forecasts of Total Freight*

	Tons (Millions)			Value (Billions $)		
	1998	2010	2020	1998	2010	2020
Domestic						
Air	9	18	26	545	1,308	2,246
Highway	10,439	14,930	18,130	6,656	12,746	20,241
Rail	1,954	2,528	2,894	530	848	1,230
Water	1,082	1,345	1,487	146	250	358
Total Domestic	**13,484**	**18,820**	**22,537**	**7,876**	**15,152**	**24,075**
International						
Air	9	16	24	530	1,182	2,259
Highway	419	733	1,069	772	1,724	3,131
Rail	358	518	699	116	248	432
Water	136	199	260	17	34	57
Other *	864	1,090	1,259	NA	NA	NA
Total International	**1,787**	**2,556**	**3,311**	**1,436**	**3,187**	**5,879**
Total Domestic and International	**15,271**	**21,376**	**25,848**	**9,312**	**18,339**	**29,954**

* Includes international shipments moved via pipeline or by unspecified mode.

Source: FHWA, Freight Analysis Framework.

Q. How is freight transportation performance measured?

A. The volume of freight moved on the U.S. transportation system has grown dramatically in recent years and is expected to increase by 70 percent by 2020. As demand for freight services grows, concerns intensify about capacity sortfalls and congestion. Understanding and improving freight flows is becoming a high priority among decision makers at all levels of government and in the private sector. An important step in understanding the issues and challenges is to measure the performance of freight transportation. The FHWA's Office of Freight Management and Operations, in partnership with the America Transportation Research Institute and others, is sponsoring the Travel Time in Freight Significant Corridors project to develop real-time performance measures for key freight corridors. This project supports the DOT's strategic goals of mobility and global connectivity.

The project uses advanced vehicle tracking and mapping technologies to determine trucks' average vehicle speeds and travel times for segments of "freight-significant" highway corridors or for the entire length of a corridor. Changes in travel speeds and times could be correlated with bottlenecks and other impediments to freight movement. Transportation planners and other professionals could use this information to identify areas in need of improvements and to prioritize future projects.

A related effort is Transport Canada's Border Wait-Time Project, which used a Global Positioning System (GPS) to estimate truck wait-times at the U.S.-Canada border. The project demonstrated the value of using GPS as a source of empirical data on wait-times and congestion patterns. The results of this effort will be used to further expand R&D efforts of mutual interest to the Canadian government and the trucking industry.

Trucks contribute significantly to congestion in urban centers. Trucks account for at least one-fifth of delay for all vehicles in the 50 worst urban bottlenecks in the Nation identified by the American Highway Users Alliance. On city streets in crowded business districts, pickup and delivery vehicles cause nearly a million hours of vehicle delay each year to other traffic as they stop to serve office buildings and retail establishments.

Over the next 20 years, congestion is expected to continue to spread beyond urban centers, and trucking will contribute to this expansion. By 2020, more than 25,000 miles of highway are likely to carry over 5,000 commodity-carrying trucks each day. Roughly one-fifth of that mileage will be significantly congested.

Trucks and Safety

Truck crashes are a major contributor to delay and a source of public concern with highway safety. In 2002, 434,000 trucks with gross vehicle weight ratings greater than 10,000 pounds were involved in traffic crashes in the United States. Of this total, 4,542 were involved in fatal crashes. As indicated in Chapter 11, a total of 4,939 people died and another 130,000 were injured in truck crashes.

Truck occupants accounted for only 14 percent of those who died in crashes involving a large truck. The majority of the fatalities in these crashes were occupants of another vehicle (79 percent). The remaining 7 percent were pedestrians or bicyclists. Truck tractors pulling semi-trailers accounted for 63 percent of the trucks involved in fatal crashes and approximately 50 percent of the trucks involved in nonfatal crashes.

Incidents involving hazardous materials account for a very small share of total fatalities and injuries involving trucks. In 2002, trucks involved in fatal and nonfatal crashes while carrying hazardous materials were 4 percent and 2 percent respectively. Hazardous material was released from the cargo compartment in 13 percent of these crashes.

Trucks and Physical Condition

Truck traffic is a major source of physical wear for the Nation's highways. According to the 1997 Vehicle Inventory and Use Survey, 70,000 trucks with typical operating weights at or above 80,000 pounds drove 3.8 billion miles (U.S. Department of Commerce Census 1997). The wear and damage to the highways caused by heavy vehicles is a frequent topic of highway cost allocation studies. The last FHWA cost allocation study found that trucks are responsible for 40 percent of FHWA program costs, while accounting for less than 10 percent of total VMT.

Consequences of Highway Performance for Trucking and the Economy

Transportation is a key element of the U.S. economy. The for-hire transportation and warehousing sector alone contributed $310 billion to U.S. Gross Domestic Product and employed approximately 4.2 million people in 2003.

Trucking is a significant component of the cost of doing business in the United States. According to the Bureau of Transportation Statistics, trucking costs account for over 7 cents of every dollar of output in the construction industry; over 6 cents in agriculture, forestry and fisheries; about 4 cents in wholesale trade; and about 2 cents in manufacturing and services. In most of these industries, the contribution of in-house trucking is larger than for-hire trucking.

Highway congestion affects motorists, freight carriers, and freight shippers. Shippers are affected through an increase in logistics costs made up of transportation costs, inventory costs, and order costs (involving the size and frequency of an order of goods). Slower and more unreliable transportation increases transportation costs directly, but also increases order costs and inventory costs.

Estimates of the cost of unreliable transportation have been presented in two recent academic papers. Shirley and Winston estimate that because of congestion, each 10 percent increase in vehicle miles traveled produces at least a $1 billion increase in annual logistics costs. They state their belief this is a conservative estimate because it assumes a uniform increase in traffic during all hours of the day and all days of the week, instead of a more realistic assumption of sharper increases during peak periods. Academic work by Winston and Langer estimate that the cost of congestion to the highway freight sector in 1997 was about $10 billion (in 2000 dollars), with a cost to motor carriers of about $2.5 billion and to shippers of about $7.6 billion.

Special Investment Needs of Freight

Most investment requirements related to truck movement are captured in the estimates provided in Chapter 7, which are largely derived from the Highway Economic Requirements System (HERS) and National Bridge Investment Analysis System (NBIAS) models. The modeling procedures used in HERS take into account such factors as trucks' share of average daily traffic on each segment and ascribe higher values of time to commercial truck movements than to trips by passenger vehicles.

Q. What is the value of time assumed for large trucks in this report?

A. This report assumes a value of time of $25.24 per vehicle hour for large trucks, compared with $15.71 for cars. Timely and reliable trucking is essential to an economy in which businesses keep inventories low and use just-in-time delivery to keep costs down. This report assumes a "reliability premium" of 200 percent, meaning that estimated nonrecurring delay is valued at twice the cost of estimated recurring delay.

In other studies in the United States and in Europe, estimated values of time for trucking range as high as $193.80, with a median value among the studies of $40 and a mean of $51.80. The value of reliability (i.e., the cost of unexpected delay) is another 50 to 250 percent higher.

The HERS and NBIAS models, however, do not directly estimate investment requirements for system components such as rest areas, intermodal connectors or border crossings (discussed below), or for rail-highway grade crossings (discussed in Chapter 19). The investment requirements identified for these system components cannot be viewed as being strictly additive to the amounts reported in Chapter 7 because some of these costs may be accounted for indirectly within the analytical models. Chapter 22 describes some of the long-term issues relating to capturing these types of costs more directly in future analyses.

Rest Areas

Crash data from the Federal Motor Carrier Safety Administration indicate that driver fatigue is a primary factor in 4.5 percent of truck-related crashes and a secondary factor in an additional 10.5 percent. The lack of parking for fatigued drivers may be a contributor to these incidents. Therefore, the probability that an insufficiency of safe parking places contributes to crashes, along with the public recognition of the greatly expanded level of commercial vehicle activity and the tighter time frames for product delivery, has helped to highlight the need for abundant, safe, and secure commercial vehicle parking for off-duty rest.

In response, TEA-21 called for a study of commercial vehicle rest parking facilities to inventory available spaces nationwide, determine current and projected shortages, and recommend solutions that could help satisfy the need for more parking, especially at night. Now completed, the *Report to Congress on the Adequacy of Parking Facilities* makes four recommendations.

- First, the report found that there is an estimated peak demand for approximately 287,000 truck parking spaces at both privately owned truck stops and travel plazas (hereinafter referred to as "privately run facilities") and at public rest areas serving those Interstate Highways and National Highway System (NHS) routes carrying more than 1,000 trucks per day.

- Second, the report found that an estimated 315,850 public and privately owned parking spaces are currently available to serve Interstate and NHS routes carrying more than 1,000 trucks daily. Roughly 10 percent of these available spaces are found at public rest areas and 90 percent at the privately owned facilities.

- Third, surveyed drivers overwhelmingly prefer privately run facilities for rest of two hours or more. Public rest areas are preferred for stops of less than 2 hours (45 to 19 percent). Private parking is preferred for its amenities (e.g., showers, food service), while public parking is preferred for ease of access and convenience to the roadway.

- Finally, 21 percent of the parking now used by drivers to obtain required rest appears to come from nontraditional rest parking locations (e.g., loading docks, company terminals, fast food restaurants, shopping centers).

Results of a driver survey, inventory, and modeling activity indicated that shortages of both public and private parking spaces may exist in at least 12 States, with shortages generally far less common at the privately run facilities.

Similarly, 23 percent of the demand for truck parking spaces was determined to be at public rest areas, although only 10 percent of the supply is available there, according to surveyed drivers. To the extent that drivers will substitute available parking at a privately run facility for that unavailable at a public one is uncertain. However, space at privately owned truck stops may be able to offset identified shortages at public rest areas in up to 35 States.

In the *Report to Congress on the Adequacy of Parking Facilities,* the U.S. Department of Transportation recognized that the larger, privately run facilities should continue to be the principal suppliers of commercial parking. Actions to expand or improve both public and private facilities, however, should be supported through (1) innovative funding initiatives, (2) cultivation and expansion of joint public-private initiatives to supply needed spaces, (3) greater use of non-traditional parking sites for truckers, (4) use of emerging technologies to provide "real-time" information to drivers about parking availability, and (5) improved signage along NHS rights-of-way to inform drivers about upcoming facilities.

Intermodal Connectors

The investment needs of intermodal connectors were estimated in a 2000 FHWA study for Congress. Many large intermodal terminals are connected to the intercity highway network by small, under-maintained roads. The report on the condition and performance of intermodal connectors identified 517 freight-only terminals, including ocean and river ports, truck/rail facilities, and pipeline/truck facilities. In addition to these freight-only terminals, 99 airports that handle both passenger and significant amounts of freight were included in the list of freight intermodal terminals. The report concluded that highway connectors to ports had twice the percentage of mileage with pavement deficiencies as non-Interstate routes on the NHS. Connectors to rail terminals had 50 percent more mileage in the deficient category than non-Interstate NHS routes. Connectors to airport and pipeline terminals appeared to be in better condition than connectors to rail terminals; they showed about the same percentage of mileage with pavement deficiencies as non-Interstate NHS routes. The report also identified geometric and physical conditions of connectors. However, it did not include an assessment of needed improvements or investment requirements. Supplemental analysis conducted since the release of that report has indicated that approximately one-third of the connector system is in need of additional capacity based on current congestion levels. Of the remaining connector mileage, 469 miles need pavement or lane width improvements, while 243 miles have adequate pavement, lane, and shoulder width.

Border Crossings

In addition to the intermodal connector problem and congestion on urban and intercity highways, many trucks have to deal with increasing delay at border crossings and other gateways. The United States shares a 5,525-mile border with Canada and a 1,989-mile border with Mexico. The U.S. maritime border includes 95,000 miles of shoreline and navigable waterways. Additionally, many airports handle international traffic throughout the country. All people and goods entering the United States legally must enter through one of over 300 land, air, or sea ports-of-entry (POEs), which are controlled POEs into the United States from foreign countries. In 2001, $1.35 trillion in imports and $1 trillion in exports passed through POEs. The Federal Motor Carrier Safety Administration is present at land POEs for truck safety inspections; and other transportation agencies play a vital role in building, operating, and maintaining the roads, rails, bridges,

and tunnels connecting to POEs. To ensure safe, secure, and efficient trade requires close and continuous coordination among inspection and enforcement agencies operating within the POEs and transportation agencies that directly and indirectly support border operations.

Conclusion

Highway condition and performance, including congestion, have a significant effect on the costs and efficiency of trucking. The importance of freight transportation in general and trucking in particular is increasingly recognized by agencies at all levels of government and will be the subject of extensive analyses and policy considerations in the years ahead.